

## REPORT DOCUMENTATION PAGE

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13. ABSTRACT (Maximum 200 words) During this project, the development of AFM experimental expertise was undertaken. An AFM was purchased and modified for the dynamic AFM measurements. The system allows the cantilever resonance frequencies to be determined both in and out of contact with a specimen. In addition, the dynamic implementation allows the surface topography and material stiffness to be mapped simultaneously. During this project, several aspects of this research were explored. One focus was on comparison of ATM methods with other experimental measurement techniques using thin films as a test base. Improved modeling of the AFM cantilevers was undertaken as it became apparent that simpler methods were not sufficient for experimental analysis. Finite element models are being constructed to include observed variations in cantilever width, thickness, and tip location. The analytical modeling has been focused on the nonlinear vibrations of ATM cantilevers with nonlinear boundary conditions. The studies of nonlinear vibrations have been extended for contact boundary conditions of a general nature such that both soft and hard contacts may be analyzed. The method of multiple scales is the primary method used for these studies. Finally, the coupling of flexural and torsional vibration modes has been examined. The coupling is the result of the specific geometry of certain ATM cantilevers. Both experimental and analytical studies have been conducted.			
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**2002 GORDON RESEARCH CONFERENCE  
on HIGH TEMP. MATERIALS, PROC. & DIAG.  
FINAL PROGRESS REPORT**

faxed  
5/21/03

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**AIR FORCE OFFICE OF SCIENTIFIC RESEARCH****GRANT NO. F49620-02-1-0355**

The Gordon Research Conference (GRC) on HIGH TEMP. MATERIALS, PROC. & DIAG. was held at Colby College from 8/4/02 thru 8/9/02. The Conference was well-attended with 98 participants (attendees list attached). The attendees represented the spectrum of endeavor in this field coming from academia, industry, and government laboratories, both U.S. and foreign scientists, senior researchers, young investigators, and students.

In designing the formal speakers program, emphasis was placed on current unpublished research and discussion of the future target areas in this field. There was a conscious effort to stimulate lively discussion about the key issues in the field today. Time for formal presentations was limited in the interest of group discussions. In order that more scientists could communicate their most recent results, poster presentation time was scheduled. Attached is a copy of the formal schedule and speaker program and the poster program. In addition to these formal interactions, "free time" was scheduled to allow informal discussions. Such discussions are fostering new collaborations and joint efforts in the field.

I want to personally thank you for your support of this Conference. As you know, in the interest of promoting the presentation of unpublished and frontier-breaking research, Gordon Research Conferences does not permit publication of meeting proceedings. If you wish any further details, please feel free to contact me. Thank you.

Sincerely,



THEODORE M BESMANN

OAK RIDGE NATIONAL LABORATORY

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# High Temperature Materials, Processes, and Diagnostics

August 4-9, 2002  
Colby College  
Waterville, ME

Chair: Ted Besmann (Oak Ridge National Laboratory)  
Vice-Chair: Klaus Hilpert (Research Center Juelich)

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## SUNDAY

2:00 pm - 9:00 pm Arrival and check-in

6:00 pm Dinner

7:30 pm - 9:30 pm **COMPUTATIONAL MODELING OF MATERIALS PROCESSES AND PROPERTIES**

Discussion Leader: **Mark Allendorf** (Sandia National Laboratories)

7:30 pm - 8:30 pm **Long Chen** (Pennsylvania State University)  
"Phase-Field Model of Microstructure Evolution"

8:30 pm - 9:30 pm **Anatoli Korkin** (Motorola Inc.)  
"New Process and Materials Design for Microelectronics: Modeling of ZrO<sub>2</sub> Film Deposition, Structure and Electronic Properties: Current Status and Challenge for Computational Material Science"

## MONDAY

7:30 am - 8:30 am Breakfast

9:00 am - 12:30 pm **CHEMISTRY AND MECHANICS OF OXIDE COATINGS**

Discussion Leader: **Brian Sheldon** (Brown University)

9:00 am - 10:00 am **Emily Carter** (University of California - Los Angeles)  
"Understanding and Mitigating Failure of Thermal Barrier Coatings from First Principles"

10:00 am Coffee Break

10:30 am - 11:30 am **Woo Lee** (Stevens Institute of Technology)  
"The Alpha-Al<sub>2</sub>O<sub>3</sub> Nanotemplate Concept: A Recipe and Mechanisms"

11:30 am - 12:30 pm **Kang Lee** (NASA-Glenn)  
"Synergistic Effects of Environment, Chemistry, and Stress on the Durability of EBCs"

12:30 pm Lunch

1:30 pm - 4:00 pm Free Time

4:00 pm - 6:00 pm Poster Session

6:00 pm Dinner

7:30 pm - 9:30 pm **GAS-SOLID INTERACTIONS**

Discussion Leader: **Francois Armanet** (ENSMA)

7:30 pm - 8:30 pm **Darryl Butt** (University of Florida)  
"Dealing with Incongruent Vaporization at Very High Temperatures"

8:30 pm - 9:30 pm **Daniele Gozzi** (Università di Roma La Sapienza)  
"Reactivity of Refractory Carbides to H<sub>2</sub> and O<sub>2</sub> at High Temperatures: Some Special Applications"

## TUESDAY

7:30 am - 8:30 am Breakfast

**9:00 am - 12:30 pm CVD KINETICS AND GROWTH BEHAVIOR**Discussion Leader: **Thomas Starr** (University of Louisville)**9:00 am - 10:00 am David Srolovitz** (Princeton University)  
"Atomistic and Microstructural Models of the Chemical Vapor Deposition of Diamond"**10:00 am** Coffee Break**10:30 am - 11:30 am Mikko Ritala** (University of Helsinki )  
"Atomic Layer Deposition of Oxide Thin Films"**11:30 am - 12:30 pm Roy Gordon** (Harvard University)  
"High Temperature Materials Using Low Temperature Chemistry"**12:30 pm** Lunch**1:30 pm - 4:00 pm** Free Time**4:00 pm - 6:00 pm** Poster Session**6:00 pm** Dinner**7:30 pm - 9:30 pm PROBING HIGH TEMPERATURE SYSTEMS**Discussion Leader: **Richard Weber** (Containerless Research)**7:30 pm - 8:30 pm David Aspnes** (North Carolina State University)  
"Real-Time Ellipsometric and Reflectance-Difference Studies of Semiconductor Growth by Organometallic Chemical Vapor Deposition"**8:30 pm - 9:30 pm Andrew Payzant** (Oak Ridge National Laboratory)  
"Time-Resolved High Temperature Diffraction Studies of Ion-Conducting Ceramic Oxides"**WEDNESDAY****7:30 am - 8:30 am** Breakfast**9:00 am - 12:30 pm HIGH TEMPERATURE ELECTRONIC AND ELECTROCHEMICAL MATERIALS**Discussion Leader: **Tim Armstrong** (Oak Ridge National Laboratory)**9:00 am - 10:00 am Manfred Martin** (RWTH Aachen)  
"Demixing and Cation Diffusion in Mixed Oxides"**10:00 am** Coffee Break**10:30 am - 11:30 am Henk Verweij** (Ohio State University)  
"Synthesis and Properties of High Temperature Membrane and Sensor Materials"**11:30 am - 12:30 pm Paul Chalker** (University of Liverpool)  
"Current Issues in the Development of III-Nitride Semiconductor Materials for High Temperature Electronics"**12:30 pm** Lunch**1:30 pm - 4:00 pm** Free Time**4:00 pm - 6:00 pm** Poster Session**6:00 pm** Dinner**7:30 pm - 9:30 pm THERMOCHEMICAL DATABASES AND PHASE RELATIONS**Discussion Leader: **Marius Stan** (Los Alamos National Laboratory)**7:30 pm - 8:30 pm Suzana Fries** (ACCESS at Aachen Hochschule)  
"Compiling, Merging, Validating, Managing and Updating Thermodynamic Databases: A Happy Never-Ending Story"**8:30 pm - 9:30 pm Lawrence Cook** (National Institute of Standards and Technology)  
"Assessing and Digital Manipulation of Phase Diagrams for the NIST-ACerS Phase Equilibrium Database"**THURSDAY****7:30 am - 8:30 am** Breakfast**9:00 am - 12:30 pm NOVEL HIGH TEMPERATURE PROCESSES**Discussion Leader: **William Potuskey** (Arizona State University)**9:00 am - 10:00 am Michel Pons** (CNRS, University of Grenoble)

"Fabrication, Characterization and Modeling of the Growth of Bulk SiC Single Crystal and Homoepitaxial Films"

10:00 am Coffee Break

10:30 am - 11:30 am **Craig Blue** (Oak Ridge National Laboratory)  
"Directed Energy Sheet Fabrication of Advanced Intermetallic and Composite Materials"

11:30 am - 12:30 pm **William Fahrenholtz** (University of Missouri - Rolla )  
"Reactive Processing Of High Temperature Materials"

12:30 pm Lunch

1:30 pm - 4:00 pm Free Time

4:00 pm - 6:00 pm Poster Session

6:00 pm

7:30 pm - 8:30 pm **NANOMATERIALS**

Discussion Leader: **Michael Zachariah** (University of Minnesota)

7:30 pm - 8:30 pm **Richard Axelbaum** (Washington University)  
"Flame Synthesis and Processing of Stable Nonoxide Nanoparticles"

8:30 pm - 9:00 pm **THERMOCHEMISTRY OF THE SOLAR NEBULA**

8:30 pm - 9:00 pm **Milton Blander** (Quest Research)  
"Calculations of the condensation of meteorites in the solar nebula"

9:00 pm - 9:30 pm Business Meeting

#### FRIDAY

7:30 am - 8:30 am Breakfast

9:00 am Departure



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# HIGH TEMP. MATERIALS, PROC. & DIAG.

Colby College  
Aug 4-9, 2002

NOTE: Receipt of Application does not guarantee acceptance to a Conference. Applications are reviewed by the Conference Chair. If the Chair approves your application, you become **Accepted** and you will be sent a personalized link to the GRC online registration site. When you complete the online registration, you become **Registered**.

Only those who have been **Accepted** or **Registered** will have their names listed below. Names of people who have only applied and have yet to be accepted will NOT appear.

Name	Organization	Participation	Status
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HATEM ALLOUCHE	CEMES/CNRS	Poster Presenter	Registered
GERALD D ALTON	ORNL	Poster Presenter	Registered
FRANCOIS ARMANET	ENSMA	Speaker	Registered
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DAVID E ASPNES	NORTH CAROLINA STATE UNIVERSITY	Speaker	Registered
RICHARD AXELBAUM	WASHINGTON UNIVERSITY	Speaker	Registered
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